Patent Claims

1. A method for producing a quartz glass material with high resistance to radiation-induced density modifications when exposed to ultraviolet radiation at about 193 nm and energy densities of the order of the working energy densities of optical systems for microlithography, comprising minimizing the peroxy defect level in the quartz glass material.

2. The method according to Claim 1, wherein the quartz glass material is produced by direct deposition.

3. The method according to Claim 1, wherein the quartz glass material is produced by a soot process.

4. The method according to Claim 1, wherein the temperature, gas composition and environment in a production flame are selected so that the ozone concentration in the flame is minimized.

5. The method according to Claim 4, wherein the ozone concentration in the flame is kept below 2 mol%.

6. The method according to Claim 4, wherein cold air is added to a substantially stoichiometric mixture of H_2 and O_2 in order to adjust the gas composition.

7. The method according to Claim 4, wherein the combustion is carried out in the presence of at least one catalyst that promotes the breakdown of ozone molecules into oxygen molecules.

8. The method according to Claim 1, wherein a hydrogen concentration during the production is set sufficiently low to achieve low hydrogen concentrations in a range of less than about $10^{16}/cm^3$ in the quartz glass material.

9. The method according to Claim 1, wherein a heat treatment of the quartz glass material is carried out at temperatures of between about 100°C and about 2000°C.

10. The method according to Claim 1, further comprising setting up a local hydrogen concentration profile in the quartz glass material..

11. The method according to Claim 10, wherein the local hydrogen concentration profile is matched to a local distribution of the energy density when the quartz glass material is in use.

12. The method according to Claim 1, further comprising introducing at least one halogen into the quartz glass material.

13. The method according to Claim 12, wherein the halogen is at least one of fluorine and chlorine.

14. The method according to Claim 1, further comprising pretreating the quartz glass material before use, the pretreatment comprising a heat treatment of the quartz glass material at temperatures of between about 100°C and about 2000°C in a hydrogen atmosphere at overpressures of between about 1 mbar and 100 bar.

15. The method according to Claim 1, further comprising doping the quartz glass material with at least one substance that substantially does not affect the optical properties of the quartz glass material,, but that is selected to bring about charge equilibration between neighboring hydroxyl groups.

16. A quartz glass material, having a low peroxy defect concentration.

17. The quartz glass material according to Claim 16, configured for use in a lithography machine.

18. The quartz glass material according to Claim 16, having a low hydrogen concentration in the range of less than about $10^{16}/cm^3$.

19. The quartz glass material according to Claim 16, which is produced by direct deposition.

20. A quartz glass material, produced by a method according to Claim 1.

21. The quartz glass material according to Claim 20, configured for use in a lithography machine.

22. An opticall system comprising at least one optical component having quartz glass material according to Claim 16.

23. The optical system according to Claim 22, configured for use in a lithography machine.

24. The optical system according to Claim 22, which is designed as an illumination system or as a projection objective for a microlithography projection exposure system.

25. A method for producing a quartz glass material with high resistance to radiation-induced density modifications when exposed to ultraviolet radiation at about 193 nm and energy densities of the order of the working energy densities of optical systems for microlithography, comprising minimizing the peroxy defect level in the quartz glass material, wherein the quartz glass material is produced by direct deposition, and wherein the temperature, gas composition and environment in a production flame are selected so that the ozone concentration in the flame is minimized.

26. The method according to Claim 25, wherein cold air is added to a substantially stoichiometric mixture of H_2 and O_2 in order to adjust the gas composition.

27. The method according to Claim 25, wherein the combustion is carried out in the presence of at least one catalyst that promotes the breakdown of ozone molecules into oxygen molecules.

28. A method for producing a quartz glass material with high resistance to radiation-induced density modifications when exposed to ultraviolet radiation at about 193 nm and energy densities of the order of the working energy densities of optical systems for microlithography, comprising minimizing the peroxy defect level in the quartz glass material, wherein a hydrogen concentration during the production is set sufficiently low to achieve low hydrogen concentrations in a range of less than about $10^{16}/cm^3$ in the quartz glass material, and wherein a heat treatment of the quartz glass material is carried out at temperatures of between about 100°C and about 2000°C.

29. The method according to Claim 28, further comprising setting up a local hydrogen concentration profile in the quartz glass material.

30. A method for producing a quartz glass material with high resistance to radiation-induced density modifications when exposed to ultraviolet radiation at about 193 nm and energy densities of the order of the working energy densities of optical systems for microlithography, comprising:

minimizing the peroxy defect level in the quartz glass material, and

introducing at least one halogen into the quartz glass material,

wherein the quartz glass material is produced by direct deposition.

31. A method for producing a quartz glass material with high resistance to radiation-induced density modifications when exposed to ultraviolet radiation at about 193 nm and energy densities of the order of the working energy densities of optical systems for microlithography, comprising:

minimizing the peroxy defect level in the quartz glass material;

introducing at least one halogen into the quartz glass material; and

pretreating the quartz glass material before use, the pretreatment comprising a heat treatment of the quartz glass material at temperatures of between about 100°C and about 2000°C in a hydrogen atmosphere at overpressures of between about 1 mbar and 100 bar.